

SIXPENCE

NOVEMBER 1941

# AMATEUR RADIO

THE  
OFFICIAL ORGAN  
OF THE  
WIRELESS INSTITUTE  
OF  
AUSTRALIA



Published by the Victorian Division

# AMATEUR-RADIO

Vol. 9. No. 10

November, 1941.

## -- A RECORDING AMPLIFIER --

by

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The amplifier may be considered as the most important link in a set up of equipment for either commercial or home recording. The other two units generally speaking, being (a) the microphone or radio tuner or a pick-up, and (b) the cutting head. Either of these departments could fall below the ideal in some respects and with the aid of equalization and various means of compensation, we could still produce a respectable recording.

As the circuit illustrates, there is nothing outstanding or unusual in such an amplifier. There are however, a certain number of special features which go towards improving the convenience and efficiency with which we may produce recordings of many sounds.

Putting the cart before the horse, we might mention first of all, that the reason for using push-pull 2A3's to feed the cutter is the comparatively low impedance, namely 5000 ohms into which they can work. This is of considerable help since a highly inductive load such as the cutting head; presents a load to the output stage which varies considerably in impedance with different frequencies. At the same time the power output of about 10 watts is a convenient value to allow a fair margin of power for good quality of sound into the cutter.

This value seems somewhat ridiculous when it is considered that one of the latest model high quality cutting heads operates at a normal level of plus 20 DB which is about .6 watt of audio frequency power, to fully modulate the track on the disc when cutting 112 lines per inch.

However there are many types and makes of cutters which require much more power than .6 watt to efficiently drive them.

Now we might commence at the beginning and deal with microphones etc; as usual inputs to our amplifier. A jack to take

one of the higher quality crystal microphones is shown in the circuit, together with a switch and input transformer for some type of dynamic or velocity microphone with an output impedance of 200 ohms. For recording speech only, a crystal microphone is excellent since the natural tendency to increase in output towards the high frequencies constitutes a form of equalization necessary in recording. For the sake of simplicity in the discussion, no means of mixing a number of microphones is shown where two mixers are shown for mixing pickups etc., and a microphone. Any number of mixers could be inserted at this point in a suitable series parallel arrangement to maintain the correct impedance match and each microphone could have its own preamplifier, consisting of one or two stages depending on the relative output level of the microphone in use.

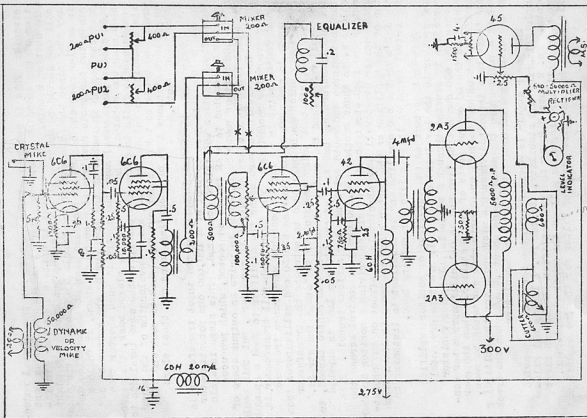
The example of one of these two stage pre-amplifiers is shown using a 6C6 connected as a pentode resistance coupled to another 6C6 triode connected, which in turn is coupled to a shunted output transformer which steps the output impedance down to 200 ohms, suitable for mixing.

Two 200 ohm mixers are shown series connected to a 500 ohm to grid input transformer. This is not a serious mismatch but a pair of 50 ohm fixed resistors inserted at points "x" would just prevent any arguments on the subject, and make no noticeable difference to the operation of the gear.

A cheap means of fading two 200 ohm pick-ups into our main P.U. mixer is by shunting an old 400 ohm variable resistor (which opens at the end) across the input to the mixer. Whilst this is a mis-match, it is only during changing from one pick-up to the other that any mis-match occurs and each pickup along "looks" into 200 ohms.

Across the primary of the input transformer is shunted the equalizer which is an important item when recordings at 33 1/3 are being made, and also very useful at the speed of 78 RPM. With the values shown this form of equalizer resonates at 5000 cycles with a gradual falling off on either side of this frequency. The insertion loss is in the region of about 12 DB but this is easily made up with ample gain in the main amplifier. Even when the best type of cutting head is used there is always a falling off of level cut on the disc, towards the higher frequencies and when we attenuate the frequencies more and more from the 5000 cycle mark down to about 50 cycles, the resulting recording is of a fair average frequency range.

Of course the function of the equalizer is not merely to produce the correct result on the finished recording after taking into consideration the limitations of the cutting head, but also as the head travels towards the centre of the disc the equalizer must be brought more and more into effect by reducing the value of the variable 1000 ohm resistor in series with the resonant



circuit. This is necessary to compensate for the gradual reduction of the speed at which the material on the disc moves past the cutting needle. This subject is quite a long story in itself and should be dealt with separately; but briefly we might say that since the diameter of the circle being cut on the disc is smaller near the centre of the disc than at the outside and since the turntable revolves at a constant speed, it follows that the length in inches of the wave cut by the cutter at say 3000 cycles (sine wave) near the centre is much shorter than that near the outside. When the disc is played back, the reproducing needle fails to drive the pickup to the same level due to its inability to follow the very short wavelengths of the sound track and tends to take a short cut from peak to peak and also on an instantaneous type of recording irons out these short wave length cuts.

Turning now to the main amplifier the input transformer is loaded by the main gain control of a 100,000 ohm potentiometer which feeds another 6C6 triode connected. This stage is again resistance coupled to a 42 triode connected, which produces about .85 watt of power being ample to drive an output stage of push-pull 2A3's into class AB region if necessary, but this would only be the case if we were using the amplifier to feed a speaker for reproducing recordings. The input push-pull transformer is shunt fed to maintain as far as possible wide range frequency response in the system, by removing the 30 odd milliamperes from the primary which would only tend to saturate the transformer core or necessitate a bulky transformer to "stand the strain." Push-pull 2A3's feed the cutter via a 5000 ohm centre tapped, to 600 ohm transformer. One side of the 600 ohm line is earthed for convenience and would not cause any serious trouble. This allows us to shunt another 250,000 ohm gain control across the cutter and feed straight to a single 45 driving a monitor speaker. This monitor stage will have absolutely no effect on the operation of the amplifier or the cutter since no power is drawn from the 2A3's or the 600 ohm line and is excellent to listening to the actual sound as it goes into our cutting head.

Just as important as the equalizer or monitor amplifier and speaker is the level indicator. A 1. m/a type dry metal rectifier is shunted through a variable multiplier resistor across the 600 ohm output line and an 0-1 milliamper meter connected to the DC output posts of the rectifier. When the gear is first set up and tested, an experimental cut would be made, the track then inspected through a microscope and the multiplier set at a point where the meter reads about .6 m/a when the track on the disc shows maximum safe level of modulation.

The power supply is divided into two sections to provide ample filtering and stability. Switch No. 1 lights all filaments. No. 2 puts H.T. on the pre amplifier stages and first two main amplifier stages as well as the monitor amplifier. This supply has an extra stage of filter for the pre amplifiers



MEMORIES OF THE PAST.

- The First Interstate Valve QSO -

It was not until well into 1919 that negotiations between the W.I.A. and P.M.G.'s Dept. resulted in permission being granted for Experimental transmission work. Several Spark Transmitters appeared, the most important being a small equipment used by Mr. Fangle, the late Government Astronomer for the Experimental transmission of Time Signals, and a somewhat larger affair installed by the W.I.A. Victn. Division at their Club Rooms at Prahran. This transmitter was complete with high-tension transformer, rotary spark gap and glass plate condenser which had the annoying habit of puncturing right in the middle of a transmission of W.I.A. Bulletin news. The Call Sign for the Transmitter was "V.240", it being the official fashion in those days to allot numerical Call Signs with the prefix letter of the State.

Spark transmission soon died as Broadcasting commenced and the first Experimental Valve Transmitters made their appearance. It must not be thought that these early transmitters were developed overnight. For Experimenters there were no valves better than small "R" and "V.24" types plus a few "Oscillaudions" so transmitting on anything on "flea power" was a practical impossibility.

Tests were carried out between 2JR and 2CM early in 1922 with 2JR operating quite unofficially of course - a 100 watt 2000 meter Service Transmitter from P.M.G. Radio Headquarters, Collins House, Melbourne under the call sign of "CH."

After it had been demonstrated that both Mr. MacLurcan, 2CM and Mr. Jack Pike, 2JP, could pick up these signals in Sydney, 2CM and 2JR co-operated in putting together a small valve transmitter at Strathfield, employing three parallel connected "V.24" receiving type Valves with an input power of NINE Watts, on a wave length of 1350 metres.

To make the best of this lower power and the truly microscopic amount that was radiated on the long wavelength employed, use was made of the tuned counterpoise system in addition to earth, and the remarkable aerial current of 500 milliamperes obtained. (2TI, 2RA, 2HF and 2HP kindly note!) This current with a calculated radiation resistance of approximately 0.1 ohms gave a radiated power of about 1/40 of a watt. During May 1922 the great test was made and 2 CM contacted 2JR in Melbourne with signals capable of being copied on a Regenerative Detector and Two Audio. SEF kept watch for 2CM's signals at Elwood and logged them during the Test.

It was not long before 2CM blossomed forth with a grid modulated carrier and all oldtimers will recall the Sunday night concerts from "Strathfield on the Strath" as Chas used to announce. While these were the first Amateur Radiophone signals in Australia, music had earlier been broadcast from A.W.A. and P.M.G. stations in Melbourne as many VK 3 Oldtimers know, but more of this anon.

T. High.

## D I V I S I O N A L   N O T E S .

### Notes From Federal Headquarters

--- By 2UV. ---

The first meeting of the new Executive took place on Monday October 27th and it was decided to make an endeavor to ascertain the extent the Australian Experimenter is participating in the National effort. With this end in view each State will be asked to circularise all hams.

It was decided that the Khaki and Blue page in "Amateur Radio" be given every support and that the various Divisions be asked to appoint an officer to collaborate details.

On Tuesday November 11th a wreath will be placed on the Cenotaph in Martin Place, Sydney in Memory of all those "Hams" who have given their life for their life for their country.

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### .. NEW SOUTH WALES DIVISION ..

By VK2TI

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The usual monthly meeting of the Division was held at Y.M.C.A. Buildings on Thursday 16th October.

The Chairman in declaring the meeting open extended a welcome to Sergeants Taylor G2 DL and "Tuffy" Jones. Both these chaps are Members of the R.A.F. and are at present on loan to Australia in an endeavor to teach we "blanky Colonials" something about R.D.F. Whether they have succeeded or they themselves gained in knowledge we can't say. G2DL gave a very interesting talk on Ham Radio in England and his remarks concerning the ease with which American gear was obtained in England prior to the outbreak of war, were heard with envy particularly when reference was made to the cost thereof!

Another interesting visitor was 4GD who gave a short talk on Ham activities in Banana Land.

I suppose everyone has heard the story that most sailors after a number of years at sea look forward to the time when they will spend the last of their days on a farm. Listen to this! John Field, VK2AKF, of Warbreccan Station, Deniliquin, recently gained his First Class Ticket and is now leaving the "farm" to go to sea! Best of luck John. Its just too bad that you won't be able to do much transmitting isn't it.

Following on a recommendation from Council, the General Meeting decided that the Institute send a Christmas Parcel to all Members of the W.I.A. known to be Prisoners of War and whose whereabouts are known.

Clarry Castle 5KL was to have given a further talk on his experiences as Wireless Operator in Central Australia at this Meeting but unfortunately 5KL has been ill and was not able to be



in attendance. It is understood that Clarry experienced some form of gastric trouble after having been to dinner at a well known VK2's home. We don't know whether it was the "Lemonade" or the change from "Army surplus". Way Say Clarry?

Another member present at this Meeting was Lieutenant Don Knock 2YC. Don is looking in the pink and was seen in earnest confab with G2DL. Don had a "G" call many long years ago - its alright Don, I won't tell how long - and had quite an interesting time comparing "then and now."

The next Meeting of the Division will be held on Thursday 20th November and all hams on service are cordially invited to come along and swap lies.

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### SLOUCH HATS AND FORAGE CAPS.

.. By VK2YC ..

In those days of no Ham transmitters, but a general transmitting of the VK Hams themselves all over the globe, only a very few know where another very few are. In this column, with everybody's help we hope to let most of the VK Hams know where all those 2, 3, 4, 5, 6 & 7 Calls are these days, and what adventure befalls them. Each Division will have a Naval, Army and Air Force representative to send notes to, or a few lines direct to VK2YC will fill the bill. If you are in Sydney, 2YC's telephone number is MU 1092 and you can give him the latest by phone, or in person. 2YC being his own Boss (ahem! 'cept for Mrs. 2YC) visitors are welcome any time. We want news, chaps, we can't have too much of it.

Introducing some DX..G2DL was along at the last VK2 Div. meeting...about time the R.S.G.B. sent out a few Hams to Empire meetings to make up for all the VE's and ZL's etc. they got. Hi! G2DL is out with the R.A.A.F. "Hush hush" Department on the Ultra Highs. Queenslander 4CB, hobnobs with him at the 'Varsity, while P/O Goyon, VK2UX pays them when they ask nicely, on the right day. Frank also pays 2HC and 5 KL who are on the last (?) W.T.G. Course at Ultimo. To end R/L 2GR, and 2AH and some more Hams give us good representation at Richmond.

Distance being no hindrance to a Ham we go a bit afield to DX Hound 2PX. For a granddaddy Harold sets us all a pretty hot pace having had a look at "operating" conditions in Libya, Greece, Crete and Syria where all "crashes" do not denote QRN. SO, chaps, think what you have to do when you're a Grandad, Hi! Harold's son is over with him too, but the Grandchild thank goodness IS at home. Where one Ham is there are sure to be others so we find 2ZK, 2 AFT, 2AHB, 2ZZ featuring in 2PX's letters.

Bill of 2HZ, along with 3YK both nice P/Os fly around Malaya and meet all the DX about the place. What with VKs, ZLs, YI, VS6, VSI, G, ZS, 2J all being in evidence, seems the place to hold a BERU Convention.

Farther up the Gulf, away from Singapore's gaiety, Corporal 2XQ perspires along with 2VI, 2ALW & a couple of VK3s.

Apart from 4CB, Arthur of 4AW is the only other VK4 that we have heard from recently. Arthur was made a P/O along with 5LD and was sent to Cootamundra to keep 2TQ and 2AIS company.

We even have some "returned men" here in VK2...2VG is back after getting safely through Libya...While 2 ALP, 2IT and 2ADI are pro tem back with the navy. After Crete, Greece and other parts of Musso's Sea they are quite "air minded," you may or may not know what I mean HI!

VK2RC is doing a P/O course in VIM, while 2ABS is another one to join the R.A.A.F. recently. He is at Richmond. 6YE, and 2TD, 2DN several other chaps keep our end up there.

Morrie 2VN was last heard of at Townsville after covering most of Oceania, and a bit of Canada. 2YA has been to VE twice but now, along with 2QL sees how well you can block at 25 per when you try to join the R.A.A.F. They should meet plenty of "it" these days of the W.A.A.Fs. I believe 2VGs sister is a W.T. Op.

Nothing has been heard of Super DXer 2ADE/4US. Charlie went over with the first squadron and has been flying around with our Sunderlands. It was heard he had collected a bit of schrapnel in the leg, been in Plymouth Blitz but nothing has come to light since.

Now chaps, plenty of us will be interested to know what the Hams you know are doing, so send in scraps of news by the of each month, or send it in, anyway, we will see it gets in. Don't forget send it to your State rep. or direct to 2YC..VK6s we hear nothing of you. How about some dope? Well, cheerio till next month, ending with the news that 3RJ has for the second time come over to VK2 to learn how to run a QSL Bureau...isn't it nice to have a column...2YC.

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#### AMATEURS - RADIO WIREMEN - AND MECHANICS NOTE

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The Army Headquarters Signals are urgently in need of the above type of men and anyone wishing to enlist with them are advised to get in touch with:-

Captain Johnson,  
A.H.Q. Signals,  
Park Orchards,  
Ringwood.....Telephone Ringwood 379.

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VICTORIAN DIVISION  
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The next meeting of the Division will be held at the Rooms on Tuesday December 2nd. On that date Lieutenant Chippendal 3VU and other members of the A.H.Q. Sigs. will present an illustrated lecture "THE HAM AT WAR." Those who were fortunate to be present at the previous visit of Lt. Chippendal will look forward to his second visit, and those who were not present are advised, that if they don't wish to miss something they haven't seen for a long time, to be sure to make a effort to get along. Several well known former Hams will be present including 9RW, 3SS, 3WE, 3GO.

At the last meeting George Manning 3XJ brought along (with the aid of 3JO's truck??) a folded horn speaker cabinet which he had constructed in his spare?? time, together with an amplifier the demonstration proved very interesting, particularly when compared with an amplifier supplied by 3JO. I understand that several of those present went home with the idea of constructing one for themselves.

3ML.. is somewhere in Queensland and has recently been promoted to the rank of Squadron Leader. Congrats Bob.

3WG.. was also on the recent list of promotions is now a Flight Lieutenant, Congrats Bill.

3WE.. has had a spell in the Heidelberg Military Hospital, but is now back again on the job.

3SS.. Sgt. Keith Scott is a member of the A.H.Q. Sigs at Ringwood.

3FW.. One of the old 200 metre gang is a member of the R.A.A.F. at present doing a course in Sydney.

3PB.. is a Pilot Officer serving with the R.A.A.F. overseas, understand that he is night flying a two seater fighter.

3XU.. is a sgt. in the 8th Div. Sigs. in Malaya.

3PR.. paid one of his occasional visits to the W.I.A. at the last meeting. Ron was supposed to be elsewhere..but radio won.

3FR.. Corporal please..seems to be having an easy time.. we've seen him twice lately.

3WY.. A very busy man keeping the wheels of industry running, wants someone to write a few technical articles for the magazine.

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The Division meets on the Third Thursday of each month at Y.M.C.A. Buildings, Pitt Street, Sydney, and an invitation is accorded to all Amateurs to be present.

**H A M S !**

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